

# **Curriculum Structure & Syllabus**

**as per  
National Education Policy -2020**

## **Bachelor of Computer Application BCA**

**[Three years Degree Course in Computer Application]  
(W.E.F. 2024-25 onwards)**



**Prof. Rajendra Singh (Rajju Bhaiya) University  
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# Prof. Rajendra Singh (Rajju Bhaiya) University, Prayagraj

## Semester-wise Course Structure / Titles of the Papers with Credit Distribution

### BCA Semester – I

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit	Max. Marks.- 100	
			L	T	P	MM=20	CIE	ETE
<b>B230101T</b>	Major	Principles of Programming Using 'C' - I	3	-	1	4	25	75
<b>B230102T</b>	Major	Computer Fundamentals	2	1	-	3	25	75
<b>B230103T</b>	Major	Digital Electronics	2	1	-	3	25	75
<b>B230104T</b>	Minor	Mathematical Foundations	3	-	-	3	25	75
<b>B230105T</b>	Minor	E-Commerce & Application	2	-	-	2	25	75
	Elective	Vocational / Skill Enhancement Course (Select from List)	3	-	-	3	25	75
	Elective	Value Added Course (Select from List)	2	-	-	2	25	75

### BCA Semester – II

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit	Max. Marks.- 100	
			L	T	P	MM=20	CIE	ETE
<b>B230201T</b>	Major	Computer System Architecture	2	1	-	3	25	75
<b>B230202T</b>	Major	Principles of Programming Using 'C' - II	3	-	1	4	25	75
<b>B230203T</b>	Major	Discrete Mathematics	2	1	-	3	25	75
<b>B230204T</b>	Minor	Statistics	3	-	-	3	25	75
<b>B230205T</b>	Minor	Cyber Security	2	-	-	2	25	75
	Elective	Ability Enhancement Courses (हिंदी भाषा कौशल एवं संचार)	3	-	-	3	25	75
	Elective	Summer Training	2	-	-	2	25	75

### BCA Semester - III

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit	Max. Marks.- 100	
			L	T	P	MM=20	CIE	ETE
<b>B230301T</b>	Major	Data Structure	2	-	1	3	25	75
<b>B230302T</b>	Major	Data Communication & Computer Network	3	-	-	3	25	75
<b>B230303T</b>	Major	Object Oriented Methodology using C++	3	-	1	4	25	75
<b>B230304T</b>	Minor	Introduction to Artificial Intelligence	2	1	-	3	25	75
<b>B230305T</b>	Minor	Block chain Technology	2	-	-	2	25	75
	Elective	Vocational / Skill Enhancement Course (Select from List)	3	-	-	3	25	75
	Elective	Value Added Course (Select from List)	2	-	-	2	25	75

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## BCA Semester - IV

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit MM=20	Max. Marks.- 100	
			L	T	P		CIE	ETE
B230401T	Major	Java Programming	3	-	1	4	25	75
B230402T	Major	Database Management Systems	3	-	-	3	25	75
B230403T	Major	Introduction to Python	2	-	1	3	25	75
B230404T	Minor	Software Engineering	2	1	-	3	25	75
B230405T	Minor	Operating Systems	2	-	-	2	25	75
	Elective	Ability Enhancement Courses (English Language Skill and Communication)	-	-	3	3	25	75
	Elective	Summer Training	-	-	2	2	25	75

## BCA Semester - V

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit MM=20	Max. Marks.- 100	
			L	T	P		CIE	ETE
B230501T	Major	Multimedia and Graphics	3	-	1	4	25	75
B230502T	Major	Design and Analysis of Algorithm	3	1	-	4	25	75
B230503T	Major	Introduction to Data Science	3	1	-	4	25	75
B230504T	Major	Introduction to PHP	3	-	1	4	25	75
B230505P	Major	Practical/Lab Work	-	-	4	4	25	75

## BCA Semester - VI

Courses/ Papers		Courses/ Papers Title	Credits			Total Credit MM=20	Max. Marks.- 100	
			L	T	P		CIE	ETE
B230601T	Major	Cloud Computing	3	1	-	4	25	75
B230602T	Major	Data Mining	3	-	1	4	25	75
B230603T	Major	Soft Computing	3	1	-	4	25	75
B230604R	Major	Major Research Project	-	-	8	8		100

# **Detailed Syllabus**

**Semester– I**

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit	Max. Marks.- 100	
			L	T	P	MM=20	CIE	ETE
<b>B230101T</b>	Major	Principles of Programming Using ‘C’ - I	3	-	1	4	25	75
<b>B230102T</b>	Major	Computer Fundamental	2	1	-	3	25	75
<b>B230103T</b>	Major	Digital Electronics	2	1	-	3	25	75
<b>B230104T</b>	Minor	Mathematical Foundations	3	-	-	3	25	75
<b>B230105T</b>	Minor	E-Commerce & Application	2	-	-	2	25	75
	Elective	Vocational / Skill Enhancement Course (Select from List)	3	-	-	3	25	75
	Elective	Value Added Course (Select from List)	2	-	-	2	25	75

## **Principles of programming using 'C' – I**

### **Introduction:**

History, Structures of 'C' Programming, Function as building blocks. Language Fundamentals Character set. C Tokens, Keywords, Identifiers, Variables, Constant, Data Types Comments.

### **Operators:**

Types of operators, Precedence and Associativity, Expression, Statement and types of statements, Building Operators and function, Console based I/O and related built in I/O function: printf(), scanf(), getch(), getchar(), putchar(), Concept of header files, Preprocessor directives: #include, #define.

### **Control structures:**

Decision making structures: If, Ifelse, Nested Ifelse, Switch, loop Control structures: While, Do while, for, Nested for loop, other statements: break, continue, goto, exit.

### **Simple Arithmetic Problems:**

Addition, Multiplication of integers, Determining if a number is  $\pm$ ve/ $\pm$ ve / even / odd, Maximum of 2 numbers, 3 numbers, Sum of first n numbers, given n numbers, Integer division, Digit reversing, Table generation for n, Factorial, sine series, cosine series. Pascal Triangle, Prime number, Factors of a number, other problems such as Perfect number, GCD numbers, swapping, etc.

**Functions:** Basic types of function, Declaration and definition, Function call, Types of function, Parameter passing, Call by value, Call by reference, Scope of variable, Storage classes, Recursion.

### **References:**

1. Programming in C-Balguruswamy
2. The C programming Language, Pearson Education - Dennis Ritchie
3. Structured programming approach using C- Forouzan & Ceilber, Thomson learning publication

## **Computer Fundamentals**

### **Introduction:**

Characteristics of Computers, Block diagram of computer. Types of computers and features, Mini Computers, Micro Computers, Mainframe Computers, Super Computers, Types of Programming Languages (Machine Languages, Assembly Languages, High Level languages). Data Organization, Drives, Files, Directories. Types of Memory (Primary and Secondary) RAM, ROM, PROM. E PROM. Secondary Storage Devices (FD, CD, HD, Pen drive) UO Devices (Scanners, Plotters, LCD, Plasma Display). Number Systems Introduction to Binary, Octal, Hexadecimal system Conversion, Simple Addition. Subtraction, Multiplication.

### **Algorithm and Flowcharts:**

Definition, Characteristics, Advantages and disadvantages, Examples, Flowchart: Definition, Define symbols of flowchart, Advantages and disadvantages, Examples.

### **Operating System and Services:**

Dos- History, Files and Directories, Internal and External Commands, Batch Files, Types of O.S. Windows Operating Environment, Features of MS- Windows. Control Panel, Taskbar, Desktop, Windows Application, Icons, Windows Accessories, Notepad, Paintbrush.

### **Editors and Word Processors:**

Basic Concepts, Examples: MS-Word. Introduction to desktop publishing Spreadsheets and Database packages Purpose, usage. Command, MS-Excel, Creation of tiles in MS-Access, Switching between application, MS PowerPoint.

### **References:**

1. Fundamental of Computers -- By V.Rajaraman B.P B. Publications
2. Fundamental of Computers — By PK Sinha
3. MS-Office 2000(For Windows) — By Steve Sagman

## **Digital Electronics**

### **Number system and Logic Gates:**

Introduction of number systems. Radix, Radix Inter-conversions. Radix Complement, Diminished radix component. Basic theorem of Boolean algebra. Boolean function and minimization, Karnaugh map, combinational circuits and their analysis. Universal Gates, Realization of Primary gates using Universal gates only.

### **Combinational logic circuits:**

Binary adder and Subtractor circuits, Magnitude comparator, Decoders, Encoders, Multiplexer and demultiplexer, Realization of switching expressions by decoders, encoders, multiplexer and Demultiplexer, Programmable logic circuits, tri-state logic, Memory Elements.

### **Sequential Logic Circuits:**

Sequential circuits, latches and Flip Flops. Analysis of clocked sequential circuits. State reduction and assignment, design of synchronous circuits, shift registers, ripple counters. synchronous counters.

### **Digital Integrated Circuits:**

Characteristics of digital ICs, Introduction to logic families- RTL, DTL. TTL, ECL, MOS and CMOS circuits and comparison.

### **References:**

1. Digital Design: M.Morris Mano (PHI)
2. Digital circuits &. logic design: S.C.Lee (PHI)
3. Digital electronics: W.H.Gothmann (PHI)
4. Switching theory: A,K Gautam (Katsons)



## **Mathematical Foundations**

### **Trigonometry and Complex Numbers:**

Trigonometry: Trigonometry Functions, Functions of angles of any magnitude, Compound and multiple angles, Inverse circular functions, Complex Numbers: Modulus, Argument of complex number, Polar form, vector form, Complex conjugate, Algebraic operations, De-Moivre's theorem, Roots of a complex number.

### **Matrices and Determinants:**

Definition of different types of matrix. Algebraic operations, Symmetric & skew symmetric matrix, Transpose of matrix, Orthogonal matrices, Rank of matrix, Determinant of a square matrix, Inverse of a square matrix, Solution of Linear Equations by Cramer's rule and Gauss-Elimination method, Eigen values & Eigen vectors of a square matrix.

### **Differential Calculus:**

Limit, Continuity and differentiability of functions, Differentiation Rules, Differentiation of functions (Algebraic, Trigonometric, Logarithmic, Exponential and inverse trigonometric functions), Tangent and normal lines, Condition of tangency, Extreme values of functions.

### **Integral Calculus:**

indefinite integrals, Basic formulae integration by parts. Integration by substitution, Definite integrals. Properties of definite integrals, Evaluation of double integration & triple integration, Application of definite integral to find Area and Volume.

### **Vector Calculus:**

Vectors in a plane, Linear dependence and independence of vectors. Vectors in space, Dot and cross-product of vectors, Gradient of vectors, Divergence of vectors, curl or vectors, Physical interpretation of gradient, Divergence and curl of vectors.

### **References :**

1. Advanced Engineering Mathematics- Erwin Kreyszig
2. Calculus: Volume I-Apostol
3. Elementary Engineering Mathematics, B SGrewal
4. Higher Engineering Mathematics, B SGrewal

## **E-Commerce & Application**

### **UNIT - I**

Introduction to E-commerce: Understanding E-commerce. E-commerce business models and concepts, Major business-to consumer (B2C) business models, Major business-to-business (B2B) business models, Business models in emerging E-commerce areas, How the internet and the Web change business

### **UNIT - II**

E-commerce infrastructure: The Internet, Technology background, The internet today, The world wide web. Building an E-commerce web site: A systematic approach, choosing server software, choosing the hardware for an E-commerce site, other E-commerce site tools.

### **UNIT - III**

Security and Encryption: The E-commerce security environment, Security threats in the Ecommerce environment, Technology solutions, Policies, Procedures and Laws, Digital Signature.

### **UNIT - IV**

E-commerce payment systems: Payment systems, Credit card E-commerce transactions, Ecommerce digital payment systems in the B2C arena, B2B payment systems. Privacy and information rights, Intellectual property rights.

### **References:**

1. E-Commerce- David Whiteley, Tata McGraw Hill
2. Electronic Commerce- Eframi Turban. Jae Lee. David King, K. Michele Chung.

**Semester – II**

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit	Max. Marks.- 100	
			L	T	P	MM=20	CIE	ETE
<b>B230201T</b>	Major	Computer System Architecture	2	1	-	3	25	75
<b>B230202T</b>	Major	Principles of Programming Using 'C' - II	3	-	1	4	25	75
<b>B230203T</b>	Major	Discrete Mathematics	2	1	-	3	25	75
<b>B230204T</b>	Minor	Statistics	3	-	-	3	25	75
<b>B230205T</b>	Minor	Cyber Security	2	-	-	2	25	75
	Elective	Ability Enhancement Courses (हिंदी भाषा कौशल एवं संचार)	3	-	-	3	25	75
	Elective	Summer Training	2	-	-	2	25	75

## Computer System Architecture

**Basic Computer Organisation and Design:** Instruction Codes, Computer registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory reference instructions, Input-Output and Interrupt, Design of Basic computer, Design of accumulator logic

**Register Transfer and Microoperations:** Register Transfer Language (RTL), register transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit, Microprogrammed Control: Control memory; address sequencing, microprogram sequencer, Design of Control Unit

**Central Processing Unit:** General registers Organization, Stack Organization, Instruction formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Program Interrupt, RISC, CISC.

**Memory Organization:** Memory hierarchy, Auxiliary Memory, Associative Memory, Interleaved memory, Cache memory, Virtual Memory, Memory Management Hardware, Input Output Organization : Peripheral devices , Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access(DMA),Input-Output Processor(IOP).

### **References:**

1. Computer Organisation and Architecture- W. Stallings, 4th Edition, Pearson Education
2. Computer Systems Design & Architecture - Harry, Jordan,, Edition, Addison Wesley
3. Computer Systems Organization & Architecture- J. D. Carpinelli, Addison Wesley.
4. Computer System Architecture By. Moris Mano, Pearson Education
5. Computer Architecture and Organization By J.P. Hayes, Tata McGraw Hill

## **Principles of Programming Using 'C' - II**

### **Arrays and Functions:**

Introduction (One and multi-dimensional), Declaration of arrays, Initialization of arrays, processing with arrays. String manipulation, declaration of string arrays, string operations. Functions: Introduction, advantages of functions, Function definition, function call, Actual and formal arguments, local and global variables, function prototypes, types of functions, recursive functions, arrays and functions.

### **Searching and Sorting:**

Selection sort, bubble sort, insertion sort, quick sort, merge sort, Searching: linear and binary search methods, comparison of sorting and searching methods.

### **Structures and Pointers:**

Introduction to structures, Advantages of structures, accessing elements of a structure. nested structures, array of structures, functions and structures, Pointers: Introduction, pointer variable, pointer operator. pointer arithmetic, pointers and arrays, pointers and strings. array pointers, dynamic allocation.

### **Files:**

Preprocessor, standard library and header files: Files: Introduction, File data type. opening and closing a file, file functions (getc, putc, getw, putw, fscanf, fprintf, (read, write, fgets, fputs, feof). Preprocessor: #define, #include, #undef, Conditional compilation directives, C standard library and header files: Header files, string functions, mathematical functions. Date and Time functions

### **References:**

1. Let us C-Yashwant Kanetkar.
2. Programming in C-Balguruswamy
3. The C programming Lang., Pearson Eel - DennisRitchie
4. Structured programming approach using C- Forouzah & Ceilber Thomson
5. Pointers in C – Yashwant Kanetkar

## **Discrete Mathematics**

### **Mathematical Logic:**

Statements, Connectives, Statement formulas, Truth functional rules, Interpretation of formulas, Tautologies,

Equivalence, Functionally complete set of connectives, Normal forms, Inference, Theory of statement calculus,

Consistency of premises.

Predicates, statement functions, Quantification, Interpretation of predicate formulas, Inference theory for predicate calculus, Informal & formal proofs.

### **Set Theory:**

Relations Relation matrix. Transitive closures, Partitions and equivalence relations, Characteristic functions or  $\chi_A$ , Principle of inclusion and exclusion, its applications

### **Directed Graphs:**

Definition Simple digraphs, Matrix representations, Paths, Distances, Connectedness of digraphs, Path and reachability matrices, Boolean sum and product of hit matrices, Warshall's algorithm for transitive closure of relations.

### **References:**

1. Discrete Mathematical Structures with Application to computer Science- Tremblay & Manohar
2. Discrete Mathematical Structures- Preparata and Yeh

## **Statistics**

### **Population, Sample and Data Condensation:**

Definition and scope of statistics, concept of population and sample with Illustration. Raw data, attributes and variables, classification, frequency distribution, Cumulative frequency distribution.

### **Measures of Central Tendency:**

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

### **Measures of Dispersion:**

Concept of dispersion, Absolute and relative measure of dispersion, range variance, Standard deviation, Coefficient of variation, Permutations and Combinations.

### **Sample space, Events and Probability:**

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, Definition or conditional probability, Definition of independence of two events, simple numerical problems.

### **References:**

1. Fundamentals of statistics - Sultan chand& sons, Delhi. - S.C,Gupta
2. - Fundamentals of statistics - D.N.Eihanee
3. Statistical Quality Control - John Welly and Sons Montgomery D.C.
4. Fundamentals of statistics - Goon, Gupta And Dasgupta

## Cyber security

### **Unit I:**

#### **An Overview of Ethics, Ethics for IT Workers and IT Users**

Ethics, Ethics in the Business World; Corporate Social Responsibility; Fostering Corporate Social Responsibility and Good Business Ethics; Improving Business Ethics; Ethical Considerations in Decision Making; Ethics in Information Technology; Managing IT Worker Relationship; Encouraging Professionalism of IT Workers — Professional Codes of Ethics, Professional Organizations, Certifications and Licensing; Encouraging Ethical Use of IT Resources among Users.

### **Unit II:**

#### **Cyberattacks, Cybersecurity, and Cyber Law**

Threat Landscape — Computer Incidents, Types of Exploits; CIA Security Triad; Confidentiality, Integrity, Availability, Implementing CIA at Organizational, Network, Application, and End-User Level; Response to Cyber Attack – Incident Notification Protection of Evidence and Activity Logs Incident Containment Eradication Incident Follow-Up Using an MSSP, and Computer Forensics; Cyber Law; Provision of Cyber Law and Electronic Transaction Act of India.

### **Unit III:**

#### **Privacy and Freedom of Expression**

Privacy Protection and the Law – Information Privacy, Privacy Laws, Applications, and Court Rulings; Key Privacy and Anonymity Issues Consumer Profiling, Electronic Discovery, Workplace Monitoring, Surveillance; First Amendment Rights; Freedom Expressions: Key Issues; Social Networking Ethical Issues.

### **Unit IV:**

#### **Intellectual Property**

Intellectual Property, Copyright; Patent; Trade Secrets; Intellectual Property Issues: Plagiarism, Reverse Engineering, Open Source Code, Competitive Intelligence, Trademark Infringement, and Cybersquatting.

### **References:**

1. Introduction of Cyber security- Jitendra Jain
2. Cyber Security Practitioner by IBM Corporation



**Semester –III**

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit	Max. Marks.- 100	
			L	T	P	MM=20	CIE	ETE
<b>B230301T</b>	Major	Data Structure	2	-	1	3	25	75
<b>B230302T</b>	Major	Data Communication & Computer Network	3	-	-	3	25	75
<b>B230303T</b>	Major	Object Oriented Methodology using C++	3	-	1	4	25	75
<b>B230304T</b>	Minor	Introduction to Artificial Intelligence	2	1	-	3	25	75
<b>B230305T</b>	Minor	Block chain Technology	2			2	25	75
	Elective	Vocational / Skill Enhancement Course (Select from List)	3	-	-	3	25	75
	Elective	Value Added Course (Select from List)	2	-	-	2	25	75

## **Data Structure**

### **Introduction:**

Data Abstraction and Algorithm, Analysis, Data types / objects / structures, Abstract definition of data structures, Representation and implementation, Time requirements of algorithms. Space requirements of algorithms.

### **Array:**

Representation of single and multidimensional arrays; Sparse arrays — lower and upper triangular matrices and Tridiagonal matrices with Vector Representation

### **Stacks, Queues and Linked list:**

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.

Linked List: Introduction, Singly linked lists, list heads, circular linked list, doubly linked lists, operations on linked list such as traversal, insertion, deletion. Searching, Applications of Linked list.

### **Trees and Graph:**

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

Graphs: Definition, terminologies and properties, Graph representations. Minimum spanning trees, Depth-first search, Breadth-first search.

### **Sorting, Searching and Hashing:**

Internal and External Sorting algorithms, Heap sort, Merge sort, Quick-sort, General radix sort, Sequential search and Binary search, Hashing: Hash functions, Collision resolution technique

### **References:**

1. Data Structures and Program Design- Robertkruse.
2. Data Structures- Horowitz and Sahni
3. Data Structures through C- A.Tennenbaum

## **Data Communication & Computer Network**

### **Basic Concept:**

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.

### **Transmission Media:**

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

### **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, ISDN: Services, Historical outline, subscriber's access, ISDN Layers and broadcast ISDN.

### **Devices:**

Repeaters, bridges, gateways, routers, The Network Layer; Design issues, Routing algorithms, Congestion control Algorithms, Quality of service, Internetworking, Network-Layer in the internet. Transport and upper layers in OSI Model' Transport layer functions, connection management, functions of session layers, presentation layer and application layer.

### **References:**

1. Computer Networks :Tanenbaum,A.S
2. Data Communication and Networking :Forouzan,B.A

## **Object Oriented Methodology using C ++**

### **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 .

### **Classes and Objects :**

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

### **Inheritance and Polymorphism :**

Inheritance , Class hierarchy , derivation classification hierarchies , Polymorphism , public.private & protected , Aggregation , composition vs Categorization of polymorphism techniques , Method polymorphism , Polymorphism by parameter , Operator overloading , Parametric Polymorphism . Generic function Template function , function name overloading , Overriding inheritance methods , Run time polymorphism , Multiple Inheritance .

### **Files and Exception Handling :**

Streams and files , Namespaces , Exception handling , Generic Classes

### **References:**

1. Object - Oriented Modeling and Design- Rumbaugh etal .
2. Object Oriented Design - Booch
3. Object Oriented Programming in C ++ -Lafore

## **Introduction to Artificial Intelligence**

### **Introduction:**

Foundation of AI, Goals of AI, The AI Problems, Importance of AI, , AI techniques, Criteria for success. Introduction to Intelligent Agents; Environment; Structure of Agent Problems, problem space and search: Defining the problem as a state space search, Production system and its characteristics,

### **Search methods :**

Problem Characteristics Searching strategies –Uninformed search and Informed search strategies. State space search, Uniformed search techniques: Depth first search, Breadth first search, Bidirectional Search, Informed search: Heuristic function, Hill climbing search, Best first search, A\* & AO\* Search, Generate and Test, Heuristic Search Techniques Hill climbing– issues in hill climbing. Problem solving using Search Techniques; Evaluation function, Mini-Max search, Alpha-beta pruning, Games of chance.

### **Knowledge representation &reasoning:**

Introduction to KR, Knowledge agent, Predicate logic, Inference rule & theorem proving forward chaining, backward chaining, Propositional knowledge, Boolean circuit agents; Rule Based Systems, Forward reasoning: Conflict resolution

### **Expert system:**

What is Expert system, Components of Expert System, Representing and using Domain Knowledge, Reasoning with knowledge, Expert System Shells, Knowledge acquisition examples.

### **References:**

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, Second Edition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel, ”Computational Intelligence : a logical approach”, Oxford University Press.
3. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education.
4. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers.

## **Block chain Technology**

### **Introduction:**

Introduction to Blockchain networks, distributed ledger, layered architecture of blockchain, Blockchain architecture, Decentralization, immutability, transparency, hashing and digital signature, Types of Blockchain: Public, private and consortium. Permission less and permissioned

### **Consensus Algorithms:**

Proof of Work(PoW), Proof of Stake(PoS), Proof of Elapsed Time (PoET), Practical Byzantine Fault Tolerance: Definition, Working, Limitations, Delegated Byzantine Fault Tolerance, Directed Acyclic Graphs.

### **Cryptocurrency:**

Definition, Types, Benefits, Limitations, Different Cryptocurrencies: Bitcoin, Ethereum, Altcoins. Crypto Wallets, Mining, Initial Coin Offering, Merkle Tree

### **Ethereum and Hyperledger:**

Ethereum blockchain, Ethereum Virtual Machine ( EVM), Ether and Gas, Smart Contracts: Definition, Features, Working of Smart Contracts, Benefits and Limitations,

### **Application and future of Blockchain:**

Blockchain in Finance, Blockchain in Governance, Blockchain in smart energy, Blockchain in supply chain management, Blockchain and Artificial Intelligence, Blockchain and Internet of Things, Applications: Land Record Management.

### **Reference Books:**

1. Block chain: Ultimate guide to understanding block chain, bit coin, crypto currencies, smart contracts and future of money- Mark Gates
2. Block chain Applications: A Hands-on-Approach, Arshdeep Bahga

**Semester - IV**

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit	Max. Marks.- 100	
			L	T	P	MM=20	CIE	ETE
<b>B230401T</b>	Major	Java Programming	3	-	1	4	25	75
<b>B230402T</b>	Major	Database Management Systems	3	-	-	3	25	75
<b>B230403T</b>	Major	Introduction to Python	2	-	1	3	25	75
<b>B230404T</b>	Minor	Software Engineering	2	1	-	3	25	75
<b>B230405T</b>	Minor	Operating Systems	2	-	-	2	25	75
	Elective	Ability Enhancement Courses (English Language Skill and Communication)	-	-	3	3	25	75
	Elective	Summer Training	-	-	2	2	25	75

## **Java Programming**

### **Unit I**

Introduction to Java: Basics of Java programming, Datatypes, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java, Objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference

### **Unit II**

Inheritance and Polymorphism in java, Super and subclass, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

### **Unit III**

Event and GUI programming: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing, Exceptional handling mechanism. I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.

### **Unit IV**

Hours Multi threading in java: Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to Java Beans and Network Programming.

### **References:**

1. Raj Kumar Buyya, Object Oriented Programming with JAVA, McGrawHill, 2009.
2. Herbert Schildt, Java A Beginner's Guide – Create, Compile, and Run Java Programs Today, 6th Edition, Oracle Press, 2014.
3. Ken Arnold, James Gosling, "The Java Programming Language, Fourth Edition, AddisonWesley, 2005.
4. Herbert Schildt, 'The Complete Reference Java, 7th Edition, McGrawHill, 2007



## Database Management Systems

### **Introduction:**

Data., information and knowledge. Characteristics of database approach, Data independence, Architecture or database system, Data dictionary, Types of database language, database system life cycle, Overview of hierarchical, network and relational model, Relations and Codd's rules, Concepts of keys, Relation Algebra - Select, Project, Joins, Set operations, Update operations — tuple relational calculus, Relational Calculus vs. relational algebra.. Data definition, data manipulation, view definition, nested queries, updation, Embedded SQL, Handling of Nulls and cursors,

### **Data Models:**

Conceptual, Logical and Physical design, ER models, ER diagrams, Strong and weak entity sets. Generalization. Specialization and Aggregation, Conversion of **ER** model into relational schemas

### **Normalization:**

Normalization concepts, Functional dependencies and dependency preservation, Normal forms 1NF, 2NF, 3NF, BCNF, 4NF, 5NF, DKNF, Indexing, file organization, De-normalization. Clustering of tallies and indexes.

### **Transaction Handling:**

Transaction recovery, System recovery, two phase commit. concurrency problems, locking. deadlocks, security, discretionary and mandatory access control, data encryption

### **References:**

1. Introduction to Database System - C.J.Date
2. Database Systems — Mcfaddenet.al.
3. Database Concepts — Navatheetat.
4. Database Structured Techniques for Design Performance — S.Atre

## Introduction to Python

### **Unit I**

Basics : Python Interpreter , writing code in Jupyter Notebook , Indentation , comments , importing a module , binary operators , standard scalar data types , type casting , if - else statements , loops ( while , for) , pass , range , ternary expressions .

### **Unit II**

Data Structures and Sequences : Tuples , Lists and slicing , Built - in Sequence functions , Dictionary , Sets; List , Set , and Dict Comprehensions . Functions : Namespaces , Scope , and Local Functions ; Returning Multiple Values .

### **Unit III**

Functions : Anonymous ( Lambda ) Functions , Partial Argument Application , Generators . Objects and Methods in Python. NumPy : creating N - dimensional arrays , arithmetic with NumPy arrays , basic indexing and slicing , Psedorandom number generation .

### **Unit IV**

Pandas : Overview of Series and DataFrames , reading data from csv file , DataFrame operations- working with data using functions like head , tail , info , shape , reshape , columns , isnull , dropna , mean , sum , describe , value\_counts , corr , loc , iloc , apply . Unit V Matplotlib- plotting basic figures , subplots , line plots , bar plots , histograms , scatter plots . Overview of Scikit - learn , SciPy , network. Basic Errors and Exception handling. Basic File Handling. Applications of python.

### **References:**

1. Python for Data Analysis : Data Wrangling with Pandas , NumPy , and Ipython , by Wes McKinney , O'Reilly Media , 2017
2. Python All - in - One for Dummies , by John Shovic and Alan Simpson , John Wiley & Sons , Inc. , 2019
3. Programming in Python 3 : A Complete Introduction to the Python Language , Mark Summerfield , Pearson .
4. Swaroop , C. H. ( 2003 ) . A Byte of Python. Python Tutorial .
5. Introduction to Computation and Programming Using Python. By John V. Guttag , MIT Press .

## **Software Engineering**

### **Evolution & Scope of Software Engineering:**

Introduction to Software Engineering Software development process, life Cycle models — Waterfall, Spiral, Evolutionary, Prototype

### **Software Production Process:**

Process Models - Methodologies; Standards estimation; Risk Analysis. Project scheduling; Quality Plans; Project control

### **Software Testing:**

Black box vs White Box, Testing in the large vs Testing in the small, System Testing; Debugging; Validation vs Verification

### **Software Design:**

Abstraction; Modularity; Cohesion; Coupling

### **Software Quality Assurance:**

Quality Models; Software Quality Assurance Activities, Software configuration management; Software Reliability; Introduction to SEI-CMM

### **Software Maintenance:**

Maintenance concepts and tasks; Side effects; Reverse Engineering: Re-engineering

### **References:**

1. Software Engineering: Ian Sommerville, Pearson Education
2. Software Engineering: R. S. Pressman, McGrawHill
3. An Integrated Approach to Software Engineering: Pankaj Jalote

## Operating System

### **Introduction:**

Definition and types of Operating systems, Batch Systems, Multiprogramming, Time Sharing. Parallel, Distributed and Real -Time Systems, Operating System Structure. Operating System components and Services, System Calls, System Programs, Virtual Machines.

### **Process Management:**

Process Concept, Process Scheduling, Cooperating Processes, Threads. Inter process Communication, CPU Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling and Algorithm evaluation.

### **Process Synchronization and Deadlocks:**

The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors, Deadlocks-System Model, characterization, Deadlock Prevention, Avoidance and Detection, Recovery from Deadlock, Combined approach to Deadlock Handling.

### **Memory Management:**

Logical and Physical Address Space. Swapping, Contiguous Allocation, Paging, Segmentation with Paging, Virtual Memory, Demand Paging and its performance, Page Replacement Algorithms, Allocation of Frames. Thrashing, Page Size and other considerations. Demand Segmentation.

### **File Management and Security:**

File Systems, Secondary Storage Structure, File concept. Access methods. Directory implementation, Efficiency and performance, Recovery,

Security: Safeguards, Penetration, Access and information flow control, Protection problems, Formal models of protection

.

### **References:**

1. Introduction of Operating Systems: Deitel
2. Operating System Concepts: Peterson and Silbershatz
3. Modern Operating Systems: Andrew S Tanenbaum

**Semester – V**

Courses Code	Core/ Elective	Courses/ Papers Title	Credits			Total Credit MM=20	Max. Marks.- 100	
			L	T	P		CIE	ETE
<b>B230501T</b>	Major	Multimedia and Graphics	3	-	1	4	25	75
<b>B230502T</b>	Major	Design and Analysis of Algorithm	3	1	-	4	25	75
<b>B230503T</b>	Major	Introduction to Data Science	3	1	-	4	25	75
<b>B230504T</b>	Major	Introduction to PHP	3	-	1	4	25	75
<b>B230505P</b>	Major	Practical/Lab Work	-	-	4	4	25	75

## Multimedia and Graphics

### **Introduction:**

The Advantages of interactive Graphics, Representative Uses or Computer Graphics, Classification of Hardware and software for Computer Graphics, Conceptual Framework for interactive Graphics, Overview, Scan: Converting Lines, Converting Circles, Converting Ellipses

### **Display Technologies:**

Raster-Scan Display System. Video Controller, Random-Scan Display Processor, Input Devices for Operator Interaction, Image Scanners, Working Exposure on Graphics Tools like Dream Weaver, 3D Effects. Clipping:

### **Geometrical Transformation:**

2-D transformation, Homogeneous Coordinates and Matrix Representation of 2D Transformations, Composition of 2D Transformations, Window-to Viewport Transformations.

### **Curves and Surfaces:**

Parametric and non-parametric curves and their representations, Cubic splines, Bezier and B-splines, Parametric surfaces, Surfaces of revolution, Sweep surfaces. Quadric surfaces, Bilinear surfaces, B-spline and Bezier surfaces, Generalized cylinders and cones. Polygon mesh and wire-frames.

### **Multimedia:**

Introduction to Multimedia. Multimedia Information, Multimedia Objects, Multimedia in business and work, Convergence of Computer, Communication and Entertainment products, Multimedia hardware, Memory & storage devices. Communication devices, Multimedia software's, presentation tools, Tools for object generations, Video, Sound, Image capturing, Authoring tools, Card and page based authoring tools. Multimedia Building Blocks- Text, Sound MIDI, Digital Audio, Audio file formats, MIDI, under windows environment, Audio & Video Capture.

### **References:**

1. Computer Graphics: Hem and Baker
2. Procedural elements in Computer Graphics: David F. Rogers
3. Mathematical Elements for Computer Graphics: David F. Rogers and L. A. Adams
4. Multimedia: Computing, Communications & Applications—Nahrstedt & Steinmetz. S. Computer Speech Processing- Fallside F.
5. Speech Analysis, Synthesis & Perception - Flanagan. Hypertext & Hypermedia Nielsen J.

## **Design and Analysis of Algorithm**

### **Algorithm Analysis Techniques:**

Recurrences: substitution, iteration and master methods. Divide-and-conquer: general approach, binary search. Matrix multiplication. Greedy algorithms: general approach. Activity selection, knapsack problem, minimum-spanning tree, Dijkstra's algorithm, Huffman code.

### **Dynamic Programming:**

General approach, matrix-chain multiplication, all-pairs shortest paths, binary search tree, traveling salesperson, Oil knapsack problem

### **Backtracking:**

N-queen problem, sum of subsets, knapsack problem, generation of all cliques, traveling salesperson problem, Graph coloring.

### **Lower Bound Theory:**

Decision tree, Reduction method; Amortized analysis; NP-completeness; Approximation algorithms

### **References:**

- 1, Fundamental of Computer algorithms - Horowitz and Sahni
- 2 Design Methods and Analysis of Algorithms — S.K.Bosu
3. The Design and Analysis of Computer Algorithms — Aho, Hopcraft and Ullman

## **Introduction to Data Science**

### **Unit I**

Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.

### **Unit II**

Data Collection and Data Pre-Processing Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

### **Unit III**

Exploratory Data Analytics Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.

Model Development Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

### **Unit IV**

Model Evaluation Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.

### **References:**

1. JojoMoolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.
2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O’Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global.



## **Introduction to PHP**

### **Unit I : Introduction to PHP:**

History of PHP, Features Merits and Demerits of PHP, General structure of PHP, Displaying Output, Escaping Special Characters, Comments, Variables – (Declaring, Assigning, Destroying), Datatypes, Setting and Testing Datatypes – Constants -Operators (Arithmetic, Comparison, Logical, Assignment, Concatenation) – Superglobal variables

### **Unit II : PHP Basics:**

Control structures – Looping structures - 1-D Array & its manipulation (Storing Data, Assigning, Accessing Array Elements, Displaying) - User-Defined Functions, Function Scope

### **Unit III : Advanced PHP and Form Interaction:**

Working with Number, Strings functions, Working with Dates and Time –Creating tables using PhpMyAdmin, Interaction with HTML form, Validating HTML Form - Error checking or Exiting – Introduction to Regular Expression, File handling

### **Unit IV : Database programming and PHP:**

Introduction to MySQL: Features, Merits and Demerits - MySQL data types and constraints -Working with Forms PHP and MySQL Integration – Basic SQL Commands (Insert, Update, Delete, Select) – MySQL functions (mysql\_connect, mysql\_select\_db, mysql\_query, mysql\_num\_rows, mysql\_fetch\_array, mysql\_fetch\_field, mysql\_close) – Generating reports using PHP and MySQL - Introduction and use of Session - Introduction and use of Cookies

### **References:**

1. PHP – A Beginner’s guide, Vikram Vaswani, TMH 2009
2. Web enabled commercial application development using HTML, Javascript, DHTML and PHP by Ivan Bayross, BPB Publication.
3. Beginning PHP5 By Dave Mercer, Allan Kent, Steven Nowicki, David Mercer, DanSquier, Wanky Choi, Wrox Publication
4. Professional PHP by Castagnetto Jesus, Shroff Publication

**Semester – VI**

Courses/ Papers		Courses/ Papers Title	Credits			Total Credit	Max. Marks.- 100	
			L	T	P	MM=20	CIE	ETE
<b>B230601T</b>	Major	Cloud Computing	3	1	-	4	25	75
<b>B230602T</b>	Major	Data Mining	3	-	1	4	25	75
<b>B230603T</b>	Major	Soft Computing	3	1	-	4	25	75
<b>B230604R</b>	Major	Major Research Project	-	-	8	8		100

## **Cloud Computing**

### **Understanding Cloud:**

Origin and influences, A brief History, Definitions, Business Drivers, Technology Innovations, Clustering Grid Computing, Virtualization, Technology Innovations vs. Enabling Technologies, Roles and Boundaries , Cloud Consumer, Cloud Service Owner, Cloud Characteristics , On-Demand Usage , Ubiquitous Access Multitenancy (and Resource Pooling) , Elasticity , Measured Usage , Resiliency

### **Cloud Delivery and cloud deployment models:**

Cloud Delivery Models, Infrastructure-as-a-Service (IaaS) , Platform-as-a Service (PaaS), Software-as-a-Service (SaaS), Comparing Cloud Delivery Models , Combining Cloud Delivery Models , IaaS + PaaS , IaaS + PaaS + SaaS , Cloud Deployment Models . Public Clouds , Community Clouds, Private Clouds, Hybrid Clouds, Other Cloud Deployment Models

### **Cloud Models:**

Introduction, Storage as a service, Amazon storage services, Compute as a service Amazon elastic compute cloud(EC2) , Cloud System matrix, Platform as Service, Windows Azure, Google Apps Engine, Amazon Web services, Software as a Service CRM as a service, sales force.com

### **Data Center:**

Introduction to Data center, Virtualization, Standardization and modularity, Automation, Remote operation and management, Data center Security and facilities, Computing hardware, storage hardware, Network hardware ,LANfabric , SANfabric, NAS gateways.

**Cloud Virtualization Technologies:** Server Virtualization, Hypervisor based Virtualization, Hardware support Virtualization, VMware Virtualization software, Storage Virtualization, Hardware independence, Server Consolidation, Resource replication, Virtualization Management, Hypervisor clustering architecture.

### **Reference Books:**

1. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
2. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg Andrzej Goscinski, John Wiley & Sons, Inc. 2011

## **Data Mining**

### **Unit I**

Introduction to Data Mining: Introduction to data mining-Data mining functionalities-Steps in data mining process- Classification of data mining systems, Major issues in data mining. Data Wrangling and Preprocessing: Data Preprocessing: An overview-Data cleaning-Data transformation and Data discretization

### **Unit II**

Predictive Modeling: General approach to classification-Decision tree induction Bayes classification methods-advanced classification methods: Bayesian belief networks- Classification by Backpropagation- Support Vector Machines-Lazy learners

### **Unit III**

Descriptive Modeling: Types of data in cluster analysis-Partitioning methods Hierarchical methods-Advanced cluster analysis: Probabilistic model-based clustering- Clustering high- dimensional data-Outlier analysis

### **Unit IV**

Discovering Patterns and Rules: Frequent Pattern Mining: Basic Concepts and a Road Map - Efficient and scalable frequent item set mining methods: Apriori algorithm, FP-Growth algorithm- Mining frequent item sets using vertical data format- Mining closed and max patterns- Advanced Pattern Mining: Pattern Mining in Multilevel, Multidimensional Space

### **Unit V**

Data Mining Trends and Research Frontiers: Other methodologies of data mining: Web mining- Temporal mining-Spatial mining-Statistical data mining Visual and audio data mining- Data mining applications- Data mining and society: Ubiquitous and invisible data mining- Privacy, Security, and Social Impacts of data mining

### **Reference Books:**

1. Ian.H.Witten, Eibe Frank and Mark.A.Hall, Data Mining:Practical Machine Learning Tools and Techniques,third edition , 2017
2. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw Hill Edition, Tenth Reprint, 2008.
3. Hand, D., Mannila, H. and Smyth, P. Principles of Data Mining, MIT Press: Massachusets. third edition, Pearson, 2013

## **Soft Computing**

### **Unit I**

Introduction to Soft Computing, Introduction to Fuzzy logic, Fuzzy membership functions, Operations on Fuzzy sets, Fuzzy relations, Fuzzy propositions, Fuzzy implications, Fuzzy inferences

### **Unit II**

Defuzzification Techniques-I, Defuzzification Techniques-II, Fuzzy logic controller-I, Fuzzy logic controller-II, Solving optimization problems, Concept of GA, GA Operators: Encoding, GA Operators: Selection-I

### **Unit III**

GA Operators: Selection-II, GA Operators: Crossover-I, GA Operators: Crossover-II, GA Operators: Mutation, Introduction to EC-I, Introduction to EC-II, MOEA Approaches: Non-Pareto, MOEA Approaches: Pareto-I,.

### **Unit IV**

MOEA Approaches: Pareto-II, Introduction to ANN, ANN Architecture, ANN Training-I, ANN Training-II, ANN Training-III, Applications of ANN

### **Reference Books:**

1. An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)
2. Principles of Soft Computing- S.N.Deepa
3. Fuzzy Logic with Engineering Applications Timothy J. Ross (Wiley)
4. Neural Networks and Learning Machines Simon Haykin (PHI)