As per NEP 2020
BCA (Bachelor of Computer Application)
(Effective from Academic Year 2024-2025 onwards)

शेखावाटी विश्वविद्यालय
Shekhawati University

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Semester I

Course Title:	Programming in C	Course Code: 24BCA5101T

Total Lecture Hour 45		Hours
Unit I	Basic concepts of Programming languages, Programming Domains, Language Evaluation criteria and language categories, Evolution of major programming languages. Describing syntax and semantics, formal methods of describing syntax, Pseudo code, Design of Algorithm & Flowchart.	10
Unit II	**Fundamentals of C:** History and importance of C, basic structure and execution of C programs, constants, variables, and data types, Various type of declarations, operators types and expressions, evaluation of expressions, operator precedence and associability. Managing input and output operations, decision making and branching. **Iteration:** while, do...while, for loop, nested loops, break & continue, go to statements.	12
Unit III	**Array and String:** One-dimensional array and their declaration and initialization, two-dimensional arrays and their initializations, character arrays (One and Two dimensional), reading and writing strings, string - handling functions. **Functions:** Need and elements for user –defined functions, definition of functions, return values and their types, function calls and declaration, recursion, parameter passing, passing arrays and strings to functions, the scope, visibility and life time of variables.	13
Unit IV	**Understanding Pointers:** Accessing the address of a variable, declaration and initialization of pointer variables, accessing a variable through its pointer, pointers and arrays, pointers and function arguments, functions returning pointers. **Structures and Unions:** Defining structure, declaring structure variable and accessing structure members, initialization of structure, operation on individual members, and array of structures, union, size of structure.	10
Reference Books:		
1	Balagurusamy E; Programming in ANSI C; Fifth Edn; Mc Graw Hill,2011.	
2	KanetkarY.; LET US C; X Edition, BPB,2010.	
3	Deitel HM & Deitel JP; C How to program; 5thEdn; Pearson Pub	
4	Gottfried B; Programming with C: Schaum Qutlines; Mc Graw Hill Edition.	

Course Title:	Programming in C Lab	Course Code: 24BCA5101P
	Content : Recommended exercises 1. Part A: 2. Program to read radius of a circle and to find area and circumference 3. Program to read three numbers and find the biggest of three 4. Program to demonstrate library functions in maths. 5. Program to check for prime 6. Program to generate n primes 7. Program to read a number, find the sum of the digits, reverse the number and check it for palindrome 8. Program to read numbers from keyboard continuously till the user presses 999 and to find the sum of only positive numbers 9. Program to read percentage of marks and to display appropriate message (Demonstration of else-if ladder) 10. Program to find the roots of quadratic equation (demonstration of switch Case statement) 11. Program to read marks scored by n students and find the average of marks (Demonstration of single dimensional array) 12. Program to remove Duplicate Element in a single dimensional Array 13. Program to perform addition and subtraction of Matrices	

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14. Part B:
15. Program to find the length of a string without using built in function
16. Program to demonstrate string functions.
17. Program to demonstrate pointers in C
18. Program to check a number for prime by defining isprime ( ) function
19. Program to read, display and to find the trace of a square matrix
20. Program to read, display and add two m x n matrices using functions
21. Program to read, display and multiply two m x n matrices using functions
22. Program to read a string and to find the number of alphabets, digits, vowels, consonants, spaces and special characters.
23. Program to Reverse a String using Pointer
24. Program to Swap Two Numbers using Pointers
25. Program to demonstrate student structure to read & display records of n students.
26. Program to demonstrate the difference between structure & union.

Course Title:	Web Application Development	Course Code: 24BCA5102T

Total Lecture Hour 45		Hours
Unit I	**The Internet** – Basic of internet, file transfer, telnet, usenet, gopher, wais. Archie and veronica. Introduction to Internet Protocols-, HTTP, FTP, SMTP protocols. **World Wide Web** : Elements of the Web, Web browser and its architecture, The web server, the proxy server, Microsoft internet explorer, viewing pages with a browser, using a browser for Mail, News and chat, Security and Privacy issues (cookies, firewalls, Data Security, executable Applets and scripts, blocking system).	10
Unit II	**HTML Fundamentals:** Introduction to HTML, HTML Elements, HTML Semantics, HTML 5 Doc Types, New Structure Tags, Section, Nav, Article, Aside, Header, Footer. HTML Attributes, Headings, Paragraphs, Styles, Quotations, Blocks, Classes, Layout, Iframes, Creating HTML Pages, incorporating Horizontal Rules and Graphical Elements, Hyper-links, Creating HTML Tables, Creating HTML Forms, HTML and Image Techniques, HTML and Page, Development of Website and Webpage (Planning, Navigation and Themes, Elements of a Web page, steps of creating a site, publishing and publicizing site structuring web site.	12
Unit III	**Cascading Style Sheets:** Understanding Style Sheets, CSS Syntax and Applying Style Sheets to HTML document, Developing Style Sheets: inline, internal and external. CSS Selectors, <DIV> tag, Using class and ID, Styling Backgrounds, Styling borders, Styling Text, Styling Fonts, Styling Links, Styling Lists, Styling Tables, Margin, Flex and Grids. **Bootstrap &Web page design:** CMS, Banks of CMS, Joomla/wordpress-Installation, Design and development of websites.	13
Unit IV	**Java script:** Introduction to scripting language, Client Side Scripting, memory concepts, arithmetic decision making. Java script control structures, Java script functions, JS Popup Boxes, events, program modules in java script, function definitions duration of identifiers, scope rules, Controlling Programming Flow, recursion java script global functions. Arrays handling in Java script, The Java Script Object Model, Developing Interactive Forms, Validation of Forms, Cookies and Java Script Security Controlling Frames in Java Script, Client – Side Java Script Custom.	10

Reference Books:	
1	The Coleteeference: HTML & X HTML; Thomas A. Powel, 4thEdn
2	Mastering HTML 4.0 by Deborah S. Rayan Eric J. Ray From BPB
3	Mastering Java Script, BPB publication.
4	Internet and web technology by Raj Kamal,TMH Publication 2.Steven Holzner,
5	The Complete Reference Java Scripts, Tata McGraw–Hill, 3rdEdn.

Course Title:	Web Application Development Lab	Course Code: 24BCA5102P

HTML:
1. Basics Elements & Attributes, HTML Formatting tags, Links,
2. Images, Tables, Forms Elements
3. HTML5 Audio and Video, HTML5 Input Types & Attributes
4. CSS Syntax, CSS Attribute Selectors
5. CSS properties: Fonts, Background, Colors, Links, Lists,
6. CSS Box Model, Display, Opacity, Float, Clear
7. CSS Layout, CSS Navigation Bar,
8. CSS Rounded Corners, CSS Border Images, CSS Animations

JavaScript:
1. Displaying Output, DeclaringVariables, Operators, Arithmetic, Data Types, Assignment,
2. JavaScript Functions, Booleans, Comparisons, Conditional
3. JavaScript Switch, Loops, Break, Type,
4. JavaScript Objects, Scope,
5. Strings and String Methods
6. Numbers and Number Methods, Math, JavaScript Dates: Formats and Methods
7. JavaScript Events, JavaScript, JavaScript Forms (API and Validation), Objects,JavaScript Functions, JavaScript DOM, JavaScript Validation, Browser BOM

Course Title:	Computer Fundamentals & Office Management Tools	Course Code: 24BCA5103T

Total Lecture Hour 45		Hours
Unit I	**Introduction to Computers**: Characteristics of computers, Evolution of computers, generation of computers, Block diagram of computer & role of each block, classification of computers. Input and Output Devices **Primary and Secondary Memory**: Memory hierarchy, Random access memory (RAM), types of RAM, Read only memory (ROM), types of ROM. Classification of secondary storage devices, magnetic tape, magnetic disk, optical disk. **Number Systems**: Introduction to number system, Binary, Octal, Hexadecimal, conversion between number bases, Arithmetic operations on binary numbers, Alphanumeric- BCD, EBCDIC, ASCII, Unicode.	11
Unit II	Computer Software: software categories, system software, application software, utility software. Classification of system software, Computer Languages: Introduction, classification of programming languages, generations of programming languages, features of a good programming language. Internet Basics: Introduction, Features of Internet, Internet applications. Services of Internet, Logical and Physical addresses, Internet Service Providers, Domain Name System. Web Basics : Introduction to Web, Web browsers, http/https, URL	12
Unit III	**MS Word:** Word processing, MS-Word features, creating saving and opening documents in Word, interface, toolbars, ruler, menus, keyboard shortcut, editing, previewing, printing & formatting a document, advance features of MS Word, find & replace, using thesaurus, mail merge, handling graphics, tables, converting a Word document into various formats like- text, rich text format, Word perfect, etc. **MS Excel:** Worksheet basics, creating worksheet, entering data into worksheet, data, text, dates, alphanumeric values saving & quitting worksheet, opening and moving around in an existing worksheet, Toolbars and menus, Keyboard shortcuts, working with single and multiple workbook, working with formula & cell referencing, Auto sum, coping formulas, absolute and relative addressing, formatting of worksheet, previewing & printing worksheet, Graphs and Charts, Database, macros, multiple worksheets- concepts.	12
Unit IV	**Power Point:** Creating and viewing a presentation, managing Slide Shows, navigating	10

	through a presentation, using hyperlinks, advanced navigation with action setting and action buttons, organizing formats with Master Slides, applying and modifying designs, adding graphics, multimedia and special effects. **Microsoft Access:** Planning a database (tables, queries, forms, reports), creating and editing database, customizing tables, linking tables, designing and using forms, modifying database structure, Sorting and Indexing database, querying a database and generating reports.	
Reference Books:		
1	SanjaySaxena; A First Course in Computers 2003 Edition; VikasPub.	
2	Computer Fundamentals by P.K.Sinha, BPB Publication.	
3	Computer Fundamentals and Programming in,ReemaThareja,OXFORDUniversity Press.	
4	Microsoft; 2007/2010 Microsoft Office System; PHI.	
5	Microsoft; Microsoft Office 2007/2010: Plain & Simple; PHI.	
6	MS-Office , Dr.S.S.Shrivastava, Published by Laxmi Publication.	
7	Office 2019:In Easy Steps,MichalPrice ,BPB Publication.	

Course Title:	Office Management Tools Lab	Course Code: 24BCA5103P
	Content: Recommended exercises based on Word, Excel, Power Point and Access.	

Semester II

Course Title:	Operating Systems	Course Code: 24BCA5201T
Total Lecture hours 45		**Hours**
Unit I	**Concepts:** Operation System & its need, functions of OS, Types of OS: Simple Batch Systems, Multiprogrammed Batched Systems, Time-Sharing Systems, Parallel Systems, Distributed Systems and Real-Time Systems. **Operating-System Structures:** System Components, Operating System Services, System Calls, System Structure, Virtual Machines, Process Management.	11
Unit II	**CPU Scheduling Algorithms: Basic** Concepts, Scheduling Criteria, FCFS, SJF, Priority, Round-Robin, Multilevel Queue, Multilevel Feedback Queue, Multiple-Processor Scheduling. **Process Synchronization &Deadlocks:** The Critical section problem, synchronization hardware semaphores, Classical problems of synchronization, Critical regions, System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock.	11
Unit III	**Memory Management:** Background, Logical versus Physical Address space, Swapping, Contiguous allocation (fragmentation), Paging, Segmentation. Virtual Memory, Demand Paging, Page-replacement Algorithms (FIFO, Optimal, LRU, Counting). **File Management:** File Concepts (Operations & Attributes), Access Methods, Directory Structure, File System Structure, Allocation Methods (Contiguous Allocation, Linked Allocation, Indexed Allocation). **Device Management:** General device characteristics, device controllers, device drivers, Interrupts Driven I/O, Memory Mapped I/O, Direct Memory.	13
Unit IV	Introduction to Linux , Evolution of Linux,Linux Architecture, Linux file system (inode, Super block, Mounting and Unmounting), Essential Linux Commands and Shell Scripts (Internal and External Commands), Kernel, Process Management in Linux.	10
Reference Books:		
1	A. Silbersachatz and P. Galvin, "Operating System Concepts", Addison-Wesley, 5th Ed., 2001.	

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2	Gary Nutt: Operating Systems - A Modern Perspective (Second Edition), Pearson Education, 2000.
3	Tanenbaum A.S., Modern Operating Systems, PHI Publ.
4	Peterson Richard, "The Complete Reference Linux", Tata McGraw Hill.
5	Simitabha Das, "Unix/Linux Concepts & Applications", Tata McGraw Hill.
6	Achyut S. Godbole: Operating Systems, Tata McGraw-Hill Publishing Company Limited, 2000.
7	Harvey M. Deitel, Operating Systems, Pearson Education, 2001.

Course Title:	Operating Systems Lab	Course Code: 24BCA5201P
	Content: Recommended exercises 1. Settings and configurations of Linux. 2. To learn directory navigation in Linux-like systems. 3. To practice Linux commands. 4. Practice pattern matching commands. 5. Practice file editing with vi/nano. 6. Shell script to demonstrate application programs.	

Course Title:	Database Management Systems	Course Code: 24BCA5202T
Total Lecture hours 45		**Hours**
Unit I	Database System Concepts & Architecture: Overview of DBMS, Basic DBMS terminology, data base system v/s file system, Advantages and dis-advantages of DBMS, Coded rules, data independence. Architecture of a DBMS, Schemas, Instances, Database Languages, Database Administrator, Data Models.	10
Unit II	**Data Modeling:** Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation. **Relational Model:** Concepts, Constraints, Languages, Relational database design by ER & EER mapping, Relational algebra relational calculus. Relational Algebra, Fundamental operations of Relational Algebra.	13
Unit III	**Database Design:** Functional dependencies, loss less decomposition, Normalization:1-NF,2-NF,3-NF and BCNF. **Transaction Management:** Transactions: Concepts, ACID Properties, States Of Transaction, Serializaibility, Isolation, Checkpoints, Deadlock Handling. **Recovery System & Security:** Failure Classifications, Recovery & Atomicity, Log Base Recovery, Recovery with Concurrent Transactions, Introduction to Security & Authorization.	12
Unit IV	**Introduction to SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Queries and sub queries, Aggregate functions, insert, update and delete operations, Joins, Unions, Intersection, Minus in SQL.	10

Reference Books:	
1	Korth HF and Silberschataz A, System Concepts, Sixth Edition; McGraw Hill, 2010 Leon, and Leon, SQL Tata McGraw Hill Pub. Co. Ltd.
2	Ivan Bayross; SQL/PL 4th Edn: BPB,2009
3	Navathe S.B. Elmasri R,; Fundamentals of Database Systems, Fifth Edition, Pearson 2011.

4	Ramakrishan and Gharke, Database Management Systems, 3rd Ed, Tata McGraw Hill, 2007.
5	Leon, and Leon, SQL Tata McGraw Hill Pub. Co. Ltd.
6	Singh S.K.; Database Systems; I Edition; Pearson, 2006.

Course Title:	DBMS Lab	Course Code: 24BCA5202P

Course Contents: Recommended Exercises
1. Analyze the organization and identify the entities, attributes, and relationships in it.
2. Identify the primary keys for all the entities. Identify the other keys like candidate keys, partial keys, if any.
3. Relate the entities appropriately. Apply cardinalities for each relationship. Identify strong entities and weak entities (if any).
4. Represent all the entities (Strong, Weak) in tabular fashion. Represent relationships in a tabular fashion.
5. Apply the First, Second, and Third Normalization levels on the database designed for the organization.
6. Practicing DDL commands.
7. Creating databases, how to create tables, altering the database, dropping tables and databases if not required. Try truncate, rename commands, etc.
8. Practicing DML commands on the Database created for the example organization.
9. DML commands are used for managing data within schema objects. Some examples: SELECT, INSERT, UPDATE, DELETE.
10. Practice queries (along with subqueries) involving ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, Constraints, etc.
11. Practice queries using Aggregate functions (COUNT, SUM, AVG, MAX, and MIN), GROUP BY, HAVING, and Creation and dropping of Views.

Course Title:	Computer Organization & Architecture	Course Code: 24BCA5203T

	Total Lecture hours 60	Hours
Unit I	**Boolean Algebra and Logic Gates**: Logic Gates, Basic laws of Boolean algebra, Simplification of Boolean algebra. **Combinatorial Logic:** Multiplexers, Decoders, Encoders, Adder & Subtracters, Parallel Binary Adder, Parallel binary Subtractor	15
Unit II	**Sequential Logic:** Sequential circuits: Flip-flops, S-R, D, J-K, T, Clocked Flip-flop, Race around condition, Master slave Flip-Flop. **Register Transfer and Micro Operations**: Register Transfer Language, Register transfer, Bus and Memory transfer, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Arithmetic Logic Shift Unit.	15
Unit III	**Basic Computer Organization and Design:** Instruction Codes, Computer Registers; Common bus system; Computer Instructions; Instruction formats; Instruction Cycle; Fetch and Decode, Flowchart for Instruction cycle; Register reference instructions, Addressing Modes. **CPU Design:** Specifying a CPU, design and implementation of a simple CPU (fetching instructions from memory, decoding and executing instructions, establishing required data paths).	15
Unit IV	**Input-Output Organization:** Input-output Interfaces, Asynchronous Data Transfer, Mode of Transfer- Programmed I/O, Interrupt I/O, Direct Memory access(DMA). **Memory Organization:** Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory. I/O Interrupt, types of Interrupts, Priority Interrupts, Direct Memory Access (DMA).	15
Reference Books:		
1	M, Morris Mano; Computer System Architectures; III Edition, Prentice Hall of India,2008	

2	Andrew S. Tanenbaum, Structured Computer Organization, Printice Hall
3	William Stallings, Computer Organization and Architecture, Sixth Edition, Pearson
4	John D. Carpinelli: Computer Systems Organization & Architecture; 3rd Edition; Person Education Asia, 2008
5	Malvino B; Digital Computer Electronics III Edition; TMHL.

Semester-III

Course Title:	Data Structures and Algorithms	Course Code: 24BCA6301T	
Total Lecture hours 45			**Hours**
Unit I	**Introduction to Algorithm Design**: Algorithm, its characteristics, efficiency of algorithms, analyzing Algorithms and problems. **Linear Structure:** Arrays, records, stack, operation on stack, implementation of stack as an array, queue, types of queues, operations on queue, implementation of queue.		12
Unit II	**Linked Structure:** List representation, Polish notations, operations on linked list - get node and freenode operation, implementing the list operation, inserting into an ordered linked list, deleting, circular linked list. **Tree Structure :** Concept and terminology, Types of trees, Binary search tree, inserting, deleting and searching into binary search tree, tree traversals		13
Unit III	**Graph Structure:** Graph representation - Adjacency matrix, adjacency list, Warshall's algorithm, adjacency multilist representation. Orthogonal representation of graph. Graph traversals - BFS and DFS. Shortest path, transitive closure.		10
Unit IV	**Searching and sorting:** Searching-sequential searching, binary searching, hashing. **Sorting-** selection sort, bubble sort, quick sort, heap sort, merge sort, and insertion sort, efficiency considerations.		10
Reference Books:			
1	S. Lioschutz: Data Structures, McGraw Hill International Edition.		
2	A. V. Aho, J. E. Hopcroft, and J. D. Ullman, Data Structures and Algorithms, Pearson.		
3	A. Michael Berman: Data Structures via C++, Oxford University Press.		
4	Sara Baase and Allen Van Gelder: Computer Algorithms, Pearson Education Asia.		

Course Title:	Data Structures Lab Using C/C++	Course Code: 24BCA6301P

Content: Recommended exercises:

1. Given {4,7,3,2,1,7,9,0} find the location of 7 using Linear and Binary search and also display its first occurrence.
2. Given{5,3,1,6,0,2,4} order the numbers in ascending order using Bubble Sort Algorithm
3. Perform the Insertion and Selection Sort on the input {75,8,1,16,48,3,7,0} and display the output in descending order.
4. Given{5,3,1,6,0,2,4} order the numbers in ascending order using Quick Sort Algorithm
5. Given{5,3,1,6,0,2,4} order the numbers in ascending order using Merge Sort Algorithm
6. Write a program to insert the elements {61,16,8,27} into singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.
7. Write a program to insert the elements {61,16,8,27} into linear queue and delete three elements from the list. Display your list after each insertion and deletion.
8. Write a program to insert the elements {61,16,8,27} into circular queue and delete 4 elements from the list. Display your list after each insertion and deletion.
9. Write a program to insert the elements {61,16,8,27}into ordered singly linked list and delete 8,61,27 from the list. Display your list after each insertion and deletion.

10. Write a program to add 6x3+10x2+0x+5 and 4x2+2x+1 using linked list.
11. Write a program to push 5,9,34,17,32 into stack and pop 3 times from the stack, also display the popped numbers.
12. Write a recursive program to find GCD of 4,6,8.
13. Write a program to inert the elements {5,7,0,6,3,9} into circular queue and delete 6,9&5 from it(using linked list implementation)..
14. Write a program to create a binary tree with the elements {18,15,40,50,30,17,41} after creation insert 45 and 19 into tree and delete 15,17 and 41from tree. Display the tree on each insertion and deletion operation
15. Write a program to create binary search tree with the elements {2,5,1,3,9,0,6} and perform in order, preorder and post order traversal.

Course Title:	Object Oriented Programming Through C++	Course Code: 24BCA6302T

Total Lecture hours 45		Hours
Unit I	**Introduction to Object Oriented Concepts:** Evolution of OOP, OOP Paradigm, advantages of OOP, comparison between functional programming and OOP approach, characteristics of object oriented language – objects, classes, inheritance, reusability, user defined data types, polymorphism, overloading.	10
Unit II	**Introduction to C++:** C++ tokens, data types, C++ operators, type conversion, variable declaration, arrays, statements, expressions, conditional statements, Jumping statements, loops, functions, pointers, structures. **Classes and Objects:** Classes, objects, defining member functions, arrays of class objects, pointers and classes, passing objects, constructors, types of constructors, destructors, this pointer, access specifiers, friend functions, inline functions.	13
Unit III	**Inheritance:** Introduction, Importance of Inheritance, types of inheritance, Constructor and Destructor in derived classes., member access control. **Polymorphism:** Functions Overloading, Operator Overloading, earl binding polymorphism with pointers, Unary and Binary Operator Overloading, Overload Assignment Operator, Copy Constructor.	12
Unit IV	**Virtual Function :** Virtual Function, late binding, pure virtual functions, abstract classes, Generic Programming with Templates, Friend function, Overloaded Function Templates, Multiple Arguments function Template. **File Management:** Handling Data files (sequential and random), Opening and closing of files, stream state member functions, Operations on File, Exception Handling.	10
Reference Books:		
1	Deitel HM & Deitel JP; C/C++ How to program; 5th Edn; Pearson	
2	Balagurusamy; Object Oriented Programming in C++; 4th Edition TMH.	
3	Mastering C++; Tata Mcgrow Hil	
4	Kanetkar Y.: LETUS C++; BPB	

Course Title:	OOP Lab	Course Code: 24BCA6302P
	Course Contents: Recommended exercises 1. Simple C++ applications for understanding references to an instant of a class 2. Handling Arrays and strings in C++ 3. Inheritance applications 4. Functions overloading 5. Operators overloading 6. Use Virtual functions 7. Generic programming	

| | 8. Exception Handling |
| | 9. File operations |

Course Title:	Networking Technologies	Course Code: 24BCA6303T
Total Lecture hours 60		**Hours**
Unit I	**Introduction:** Network definition, Network topologies, Types of Network, Layered network architecture, Categories of Network, protocol, Standards and interface. **Network Models:** client-server, peer-to-peer, OSI reference model, Architecture and functions of layers. TCP/IP protocol suite.	12
Unit II	**Data Communication Fundamentals:** Analog and digital signal, Data-rate limits, Digital to digital & Digital to analog modulation. Guided and Unguided Transmission media **Data Link Layer and Network Devices:** Data link layer: framing, error detection and Corrections, flow control, Network devices: switches, routers, bridges, etc., MAC addressing and Ethernet standards.	14
Unit III	**Networks Layer Functions and Protocols:** Routing, Routing algorithms, Network layer protocol of Internet - IP protocol. **Transport Layer Functions and Protocols:** Transport services, Berkeley socket interface overview, Transport layer protocol of Internet - UDP and TCP. Overview of Application layer protocol, DNS protocol, WWW & HTTP protocols.	13
Unit IV	**Circuit Switching:** Simple Circuit Switching, Circuit Switching Networks, Space Division switching, Time Division Multiplexing, Routing in Switching Networks, Control Signals & Channels. Packet Switching concepts and principles. **Network Security and Wireless Networks:** Network security concepts: encryption, firewalls, VPN, Wireless networks and technologies.	13
Reference Books:		
1	Behrouz A. Forouzan, "Data Communication and Networking", 4th edition, Tata McGraw Hill.	
2	A.S. Tanenbaum, "Computer Networks", Pearson Education Asia,4th Ed..	
3	William Stallings, "Data and computer communications", Pearson education Asia, 7th Ed.	
4	"Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross	

Semester-IV

Course Title:	PHP Programming	Course Code: 24BCA6401T
Total Lecture hours 45		**Hours**
Unit I	**Introduction to PHP:** Installation of PHP and MySQL, PHP configuration in IIS & Apache Web Server. Features of PHP, Writing PHP, Parsing PHP code, Embedding PHP and HTML Executing PHP and viewing in Browser.	10
Unit II	**Control Structures:** Data types, Operators, PHP variables: static and global variables, Comments in PHP, Control Structures, Condition statements, If...Else, Switch? operator, Loops, While, Break Statement Continue. Do...While, For, For each, Exit, Die, Return. Arrays: Numeric, Associative and Multidimensional Arrays	12
Unit III	**Strings:** Creating and accessing String, Searching & Replacing String, Formatting String, String Related Library function, Pattern matching, Replacing text, Splitting a string with a Regular Expression **Functions:** Defining a Function, Calling a Function, Parameter passing, Returning value from function **Form Data Handling:** $_GET, $_POST, $_REQUEST Variables, Cookies handling,	13

	Session Management	
Unit IV	**Exception Handling:** Understanding Exception and error, Try, catch, throw **File Handling:** Opening and closing a file, Copying, renaming and deleting a file **Database Handling:** Connection with MySql Database or ODBC, Performing basic database, operation (Insert, Delete, Update, Select, Truncate Alias, Order By), Setting query parameter.	**10**

Reference Books:

1	PHP, The Complete Reference, Steven Holzner, TMH
2	Beginning PHP 5.3, Matt Doyle, John Wiley & Sons
3	Core PHP Programming Leon Atkinson Pearson publishers
4	Beginning PHP 5.0 Database Christopher Scollo, Harish, Rawat, Deepak Thomas, Wrox Press

Course Title:	**PHP Lab**	**Course Code: 24BCA6401P**
	Content: Recommended exercises: Exercise based on paper PHP Programming ● Installing XAMMP ● Variables, Data Types, Constants, Operators, Programming Loops, ● PHP Functions, ● Arrays ● Strings Functions ● PHP Form Handling, Require & Include ● PHP with MySQL	

Course Title:	**Object Oriented Concepts Using Java Programming**	**Course Code: 24BCA6402T**	
Total Lecture hours 45			**Hours**
Unit I	**Java Programming :** Basic concepts of object oriented programming(Objects and Classes, Data Abstraction & Encapsulation, Inheritance, Polymorphism, Dynamic binding, Message passing), Java features, JVM, Byte code interpretation, simple java program, command line argument, Data types, type casting, operators (Arithmetic, increment, decrement, relational, logical, bit wise, conditional) and expressions.		**10**
Unit II	**Decision Making and Branching:** Decision making and branching (if...else, else if, switch), looping, classes, objects and methods, visibility control, constructors, wrapper classes, nesting of methods, Arrays and strings handling. **Polymorphism:** Function overriding, Operator overloading, final classes.		**10**
Unit III	**Inheritance & Multithreaded Programming :** Inheritance, Types of Inheritance, Abstract class, interfaces, packages, multithreaded programming, extending thread, life cycle of thread, using thread methods, thread priority, synchronization. **Exception Handling:** Exception-Handling fundamentals, Exception types, try, catch, throw, finally, creating exception sub classes.		**11**
Unit IV	JSP: Introduction to JSP, Directory Structure, Lifecycle JSP, Scripting Elements. JAR files, Servlets Life cycle of servlet, JDBC connectivity.		**8**

Reference Books:

1	Mastering java 2", BPB Publications. Programming with Java A Primer, E. Balagurusamy Tata McGraw Hill Companies
2	Java Programming John P. Flynt Thomson 2nd
3	The complete reference JAVA 2, Herbertschildt.TMH
4	Arnold, Gosling, "The Java Programming Professional 2000", Addison Wesley Publication

Course Title:	Java Lab	Course Code: 24BCA6402P
	Content: Recommended exercises: 1. Simple java applications for understanding references to an instant of a class 2. Handling Arrays in JAVA 3. Handling strings in JAVA 4. Implementation polymorphism 5. Package creation 6. Developing user defined packages in java 7. Use of Inheritances 8. Use of Interfaces 9. Threads, Multithreading 10. Collection handling 11. GUI/Swings applications 12. I/O Stream handling 13. Exception Handling 14. JSP 15. Servlets	

Course Title:	Mathematics & Statistics	Course Code: 24BCA6403T

Total Lecture hours 60		Hours
Unit I	**Sets :**Definition of sets, representation of sets, type of sets, Operations on sets, Sub sets, Power set, Universal set, Complement of a set, Union and Intersection of two sets, Venn diagrams, Principles of Inclusion and Exclusion. **Relations:** Cartesian product of sets, Definition of relation, Types of relations- reflexive, symmetric, anti-symmetric, transitive, equivalence. **Functions:** Definition, Domain & Range of a functions, one to one and onto functions, Bijective functions, composite functions, inverse of functions.	14
Unit II	**Logic and Proofs:** Proposition, Conjunction, Disjunction, Negation, Compound proposition, De Morgan's laws, Tautology and Contradiction. **Matrices:** Definition and Types of Matrices, Addition, Subtraction and Multiplication of Matrices, Non- commutatively of multiplication of matrices, Scalar Multiplication, Transpose of a Matrix. **Determinant:** Determinant of a square matrix (up to 3x3 matrices), properties of determinants, minors , cofactors, expansion of determinants, application of determinants in finding the area of a triangle. Adjoint and Inverse of a matrix, Solution of system of linear equations by Cramer's Rule.	13
Unit III	**Statistics:** Data collection methods, Data classification, Frequency Distribution, Graphical representation of frequency distribution. **Measures of Central Tendency-** Mean, Median, Mode, Measures of Dispersion- Mean Deviations, Standard Deviations, Variance	12
Unit IV	**Correlation Analysis:** Correlation, Types of Correlations, Methods of Studying Correlations, Measure of Karl Pearson's coefficient of correlation, Rank Correlation Coefficient. **Regression Analysis:** Regression, Use of regression analysis, Difference between Correlation and Regression Analysis, Regression Lines Equations, Properties of regression lines.	13
Reference Books:		
1	C.L. Liu: Elements of Discrete Mathematics, Tata Mc-Graw Hill Publishing Company Ltd., 2000	
2	Seymour Lipschutz; Discrete Mathematics; TMH.	
3	Kenneth H Rosen; Discrete Mathemtics & Its Applications; 6 Edition, MGH;	

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Semester – V

Software Engineering

Course Title:	Software Engineering	Course Code: 24BCA7501T
Total Lecture hour 60		**Hours**
Unit I	**Software Engineering Fundamentals:** Software, Problem Domain, Software Engineering Challenges, Software Processes (processes, projects & products, component), Software Requirement Analysis & Specification. **Software Development Process Models:** Waterfall Model, Prototyping, Iterative Enhancement Model, Spiral Model. Introduction to Agile Model: Principles, Steps, Various Agile Process Models.	16
Unit II	**Software Project Planning:** Cost Estimation- Uncertainties in Cost Estimation, Building Cost Estimation Models, On Size Estimation, COCOMO Model. **Project Scheduling:** Average Duration Estimation, Project Scheduling & Milestones. Quality Assurance Plans: Verification & Validation, Inspection & Reviews.	14
Unit III	**Design Engineering:** Design Process & Design Quality, Design Concepts (abstraction, architecture, modularity, functional independence, refinement, and design classes), The Design Model (data design elements, architectural design elements, interface design elements, component-level design elements, deployment-level design elements). **Testing Strategies & Tactics:** A strategic approach to software testing, Strategic issues, Software testing fundamentals, Test characteristics, Test Strategies for conventional software: Unit Testing, Integration testing, Validation Testing, System testing, Black-Box testing, White Box testing.	16
Unit IV	**Software Reliability:** Risk Management, Measures of Reliability & Availability, Software Safety. **Maintenance and Reengineering**: Introduction to Software Maintenance, Software Supportability, Reengineering, Reverse Engineering, Restructuring, and Forward Engineering.	14
Suggestive Readings:		
1.	Pressman, Roger (2001) Software Engineering; A Practitioner's Approach, 8th ed. M Graw-Hill,2014.	
2.	Sommerville Lan; Software Engineering, 9thEd.Pearson Education,2014	
3.	Jalote, Pankaj (7) An integrated Approach to Software Engineering 2ndEd.	

Artificial Intelligence

Course Title:	Artificial Intelligence	Course Code: 24BCA7502T
Total Lecture hour 45		**Hours**
Unit I	**Introduction:** Concept of Intelligence, Introduction to Artificial Intelligence, Background and Applications, AI intelligent agents, Agents and Environments, Characteristics of AI, AI techniques, Defining problem as a state Space Search, Tic-Tac- Toe problem, Problem Characteristics, Comparison of AI, Machine Learning and Deep Learning.	13
Unit II	**Problem Solving and Searching Techniques:** Problem Characteristics, Production Systems, Water Jug Problem, Block Words Problem, Control Strategies, Searching for Solutions, Breadth First Search, Depth First Search, Hill climbing and its Variations, Heuristic Search Techniques: Best First Search. 8-Puzzle Problem.	10
Unit III	**Knowledge Representation:** Definition of Knowledge, Types of Knowledge (Procedural and Declarative Knowledge), Knowledge-Based Systems, Representation of Knowledge. Introduction to First Order Predicate Logic, Conversion to clausal form, Unification, Resolution	10

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	Principle.	
Unit IV	**Expert Systems:** Introduction to Expert Systems, Characteristic Features of Expert Systems, Applications of Expert Systems, Components and Working of Expert Systems, The Development Process of Expert System, Structure of Expert System, Human Expert Vs Expert System, Types of Expert System, Benefits of Expert System, Limitation of Expert System.	12

Suggestive Readings:

1.   Elaine Rich, "Artificial Intelligence", Tata McGraw Hill, 3rd edition, 2012.
2.   Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems".
3.   Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 2nd Edition, Pearson Education, 2004.
4.   George F. Luger, "Artificial Intelligence: Structures and Strategies for Complex Problem Solving", Pearson Education, 4th edition, 2002.
5.   Patrick Henry Winston, "Artificial Intelligence", Pearson Education, 3rd Edition, 2001.
6.   Deepak Khemani, "Artificial Intelligence: A Modern Approach", Tata McGraw Hill Education (India), 2013.

Artificial Intelligence Lab

Course Title:	Artificial Intelligence Lab	Course Code: 24BCA7501P
	1. Sense the Available Networks using Arduino. 2. Measure the Distance using Ultrasonic Sensor and make LED blink using Arduino. 3. Detect the Vibration of an object using Arduino. 4. Connect with the available Wi-Fi using Arduino. 5. Sense a Finger when it is placed on Board using Arduino. 6. Temperature Notification using Arduino. 7. LDR to vary the Light intensity of LED using Arduino. 8. MySQL Database Installation in Raspberry Pi. 9. SQL Queries by fetching Data from Database in Raspberry Pi. 10. Switch Light on and off Based on the user using Raspberry Pi.	

Python Programming

Course Title:	Python Programming	Course Code: 24BCA7503T
Total Lecture hour 45		Hours
Unit I	**Python Concepts:** Origin, Comparison, Comments, Variables and Assignment, Identifiers, Basic Style Guidelines, Standard Types, Internal Types, Operators, Built-in Functions, Numbers and Strings. Sequences: Strings, Sequences, String-Operators & functions, Special Features of Strings, Memory Management, programs & examples. **Conditionals and Loops:** if statement, else Statement, elif Statement, while Statement, for Statement, break Statement, continue Statement, pass Statement, else Statement.	12
Unit II	**Object and Classes:** Classes in Python, Principles of Object Orientation, Creating Classes, Instance Methods, Class variables, Inheritance, Polymorphism, Type Identification, Python libraries (Strings, Data structures & algorithms). **Lists and Sets:** Built-in Functions, List type built in Methods, Tuples, Tuple Operators, Special Features of Tuples, Set: Introduction, Accessing, Built-in Methods (Add, Update, Clear, Copy, Discard, Remove), Operations (Union, Intersection, Difference).	10
Unit III	**Dictionaries:** Introduction to Dictionaries, Built-in Functions, Built-in Methods, Dictionary Keys, Sorting and Looping, Nested Dictionaries.	12

	Files: File Objects, File Built-in Function, File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules. **Regular Expression**: Introduction/Motivation, Special Symbols and Characters for REs, REs and Python.	
Unit IV	**Exceptions:** Concepts of Exceptions, Exceptions in Python, Detecting and Handling Exceptions, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions. **Database Interaction:** SQL Database Connection using Python, Creating and Searching Tables, Reading and storing config information on database, Programming using database connections. **Python Multithreading:** Understanding threads, Forking threads, synchronizing the threads, Programming using multithreading.	**11**

Suggestive Readings:
1. R.NageswaraRao, "Core Python Programming", Dreamtech Press, 2nd Edition, 2018 2. Dr. M. Suresh Anand, Dr. R. Jothikumar, Dr. N. Vadivelan, "Python Programming", Notion Press, 1stEdition, 2020 3. MartinC.Brown, "The Complete Reference Python", McGraw Hill Education, 4th Edition, 2021. 4. AshokNamdevKamthane; "Programming and Problem Solving with Python";2nd Edn, MGH,2020 5. AllenB.Downey, "Think Python", O'Reilly Media, 2016

Python Lab

Course Title:	**Python Lab**	**Course Code: 24BCA7502P**
Content: Recommended exercises: 1. Write a program to demonstrate basic data type in python. 2. Create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear() 3. Create a tuple and perform the following methods 1) Add items 2) len() 3) check for item in tuple 4)Access items 4. Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len() 5. Write a program to create a menu with the following options 1. TO PERFORM ADDITITON 2.TO PERFORM SUBTRACTION 3. TO PERFORM MULTIPICATION 4. TO PERFORM DIVISION Accepts users input and perform the operation accordingly. Use functions with arguments. 6. Write a python program to print a number is positive/negative using if-else. 7. Write a program for filter() to filter only even numbers from a given list. 8. Write a python program to print date, time for today and now 9. Write a python program to add some days to your present date and print the date added. 10. Write a program to count the numbers of characters in the string and store them in a dictionary data structure. 11. Write a program to count frequency of characters in a given file. 12. Using a numpy module create an array and check the following: 1. Type of array 2. Axes of array 3. Shape of array 4. Type of elements in array. 13. Write a python program to concatenate the data frames with two different objects. 14. Write a python code to read a csv file using pandas module and print the first and last five lines of a file. 15. Write a python program which accepts the radius of a circle from user and computes the area (use math module).		

Semester – VI

Machine Learning

Course Title:	Machine Learning	Course Code: 24BCA7601T
Total Lecture hour 45		**Hours**
Unit I	**Concepts:** Machine Learning, Machine Learning Foundations-Overview, Applications, Types of Machine Learning, Basic Concepts in Machine Learning – Examples of Machine Learning, Issues in Machine Learning, Artificial Intelligence, Artificial Intelligence vs. Machine Learning.	12
Unit II	**Supervised Learning:** Introduction, Linear Models of Classification – Decision Trees, Naïve Bayes Classification, Linear Regression, Logistic Regression, Bayesian Logistic Regression, Probabilistic Models Neural Network, Feed Forward Network Functions, Error Back Propagation, Regularization.	10
Unit III	**Unsupervised Learning:** Clustering, Association rule mining, K-Means Clustering, EM (Expectation Maximization), Mixtures of Gaussians, EM algorithm in General, The Curse of Dimensionality, Dimensionality Reduction, Factor Analysis, Principal Component Analysis.	10
Unit IV	**Reinforcement Learning:** The Learning Task, Instance Based Learning, Nearest neighbour classification, K-nearest neighbour, Elements of Reinforcement Learning, Difference between Reinforcement Learning and Supervised Learning, Application of Reinforcement Learning. **Probabilistic Graphical Models:** Directed Graphical Models, Bayesian Networks, Exploiting Independence Properties, From Distributions to Graphs, Markov Random Fields, Inference In Graphical Models, Learning, Naïve Bayes Classifiers, Markov Models, Hidden Markov Models.	13
Suggestive Readings:		
1. Stuart Russell, Peter Norving, "Artificial Intelligence: A Modern Approach", Pearson Education, 3rd edition, 2010.		
2. MitchellT.M., Machine Learning, McGraw Hill		
3. Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag		
4. JoelGrus, "Data Science from Scratch-First Principles with Python", O'Reilly, 2015		
5. M. Gopal, "Applied MACHINE LEARNING", McGraw-Hill, 2018		

Machine Learning Lab

Course Title:	Machine Learning Lab	Course Code: 24BCA7601P

Content: Recommended exercises:
1. Install and set up Python and essential libraries like NumPy and pandas.
2. Introduce scikit-learn as a machine learning library. 3
3. Install and set up scikit-learn and other necessary tools.
4. Write a program to Load and explore the dataset of .CVS and excel files using pandas.
5. Write a program to Visualize the dataset to gain insights using Matplotlib or Seaborn by plotting scatter plots, bar charts.
6. Write a program to Handle missing data, encode categorical variables, and perform feature scaling.
7. Write a program to implement a k-Nearest Neighbours (k-NN) classifier using scikit- learn and Train the classifier on the dataset and evaluate its performance.
8. Write a program to implement a linear regression model for regression tasks and Train the model on a dataset with continuous target variables.
9. Write a program to implement a decision tree classifier using scikit-learn and visualize the decision tree and understand its splits.
10. Write a program to Implement K-Means clustering and Visualize clusters.

Cloud Computing

Course Title:	Cloud Computing	Course Code: 24BCA7602T
Total Lecture hour 60		**Hours**
Unit I	**Introduction of Cloud Computing:** Definition, Historical Developments, Enabling Technology, Vision, Essential Characteristics of Cloud Computing, Components of Cloud Computing. **Challenges and Approaches of Migration into Cloud, Cloud Applications:** Health care, CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming. **Benefits:** For the Market, Enterprise, End user and Individuals.	16
Unit II	**Cloud Computing Architecture:** Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance. Parallel and distributed Computing-Map Reduce, High level Language for Cloud, Service Oriented Computing.	14
Unit III	**Virtualization:** Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Virtualization of CPU, Memory, I/O Devices, Server, Desktop, Network, and data-center. Pros and Cons of Virtualization, Technology Examples-VMware and Microsoft Hyper-V, KVM, Xen. **Introduction of Cloud security services:** Design Principles, Policy Implementation, Cloud Computing Security Challenges, Cloud Computing Security Architecture, Cloud Security technologies to secure the data in Private and Public, Security Concerns, Risk Mitigation, Understanding and Identification of Threats in Cloud, SLA-Service Level Agreements.	16
Unit IV	**Cloud Platforms in Industry:** Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services, Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model.	14

Suggestive Readings:

1. Cloud Computing ,Principle and Paradigms, Edited By RajkumarBuyya, JemesBroberg, A.Goscinski, Pub.-Wiley-2016.

2. KumarSaurabh, "Cloud Computing" , Wiley Pub 2016.

3. "Cloud Computing: Concepts, Technology & Architecture" by ThomasErl, RicardoPuttini, and ZaighamMahmood.

4. "Cloud Computing: A Practical Approach" by AnthonyT.Velte, Toby J.Velte, and RobertElsenpeter.

5. Mastering Cloud Computing by Rajkumar Buyya, ChristianVecchiola, S.ThamaraiSelvi from TMH2013.

6. Distributed and Cloud Computing, KaiHawang , GeofreyC.Fox, JackJ.DongarraPub: Elservier, 2013.

7. Krutz , Vines, "Cloud Security " , Wiley Pub,2010

8. Katarinan Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, "Grid and Cloud Computing Business Perspective on Technology and Applications", Springer,2010.

Introduction to Data Science

Course Title:	Introduction to Data Science	Course Code: 24BCA7603T
Total Lecture hour 45		**Hours**
Unit I	**Introduction to Data Science:** Concept of Data Science, Need for Data Science, Components	12

	of Data Science, Big data, Facets of data: Structured data, Unstructured data, Machine-generated data, Graph-based or network data, Audio, image and video, Streaming data, The need for Business Analytics, Data Science Life Cycle, Applications of data science.	
Unit II	**Data Science Process:** Overview of data science process, setting the research goal, Retrieving data, Cleansing, integrating and transforming data, Exploratory data analysis. Data Modeling, Presentation and automation. **Data Analytics:** Types of Analytics, Data Analytics Lifecycle: Overview - Discovery - Data Preparation - Model Planning - Model Building, Regression analysis, Classification techniques, Clustering, Association rules analysis.	13
Unit III	**Statistics**: Basic terminologies, Population, Sample, Parameter, Estimate, Estimator, Sampling distribution, Standard Error, Properties of Good Estimator, Measures of Central tendency, Measures of Spread, Probability, Normal Distribution, Binary Distribution, Hypothesis Testing ,Chi-Square Test.	10
Unit IV	**Data Science Tools and Algorithms**: Basic Data Science languages- R, Python, Knowledge of Excel, SQL Database, Introduction to Weka, Regression Algorithms - Linear Regression, Logistic Regression, K-Nearest Neighbors Algorithm, K-means algorithm.	10

Suggestive Readings:

1. Samuel Burns, "Fundamentals of Data Science: Take the first Step to Become a Data Scientist" , Amazon KDP Printing and Publishing, First Edition, 2019.
2. Davy Cielen , ArnoD. B. Meysman, Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
3. CathyO' Neil and Rachel Schutt, "Doing Data Science, Straight Talk From The Frontline", O'Reilly. 2014.

Data Science Lab

Course Title:	Data Science Lab	Course Code: 24BCA7602P
	R Programming: Fundamentals, Properties & Characteristics, Data Types, Operators, Control & Looping Structures, Array & String handling, Functions, Vector & Matrices processing, Factors, Data Frames, Packages, Data Reshaping, Data and File management, Charts and Graphs. **Data science with R/Python:** Overviews, data visualization using graphics in R, GG plot 2, File format of graphics output, introduction to hypotheses, types of hypothesis, data sampling, confidence and significance level, hypothesis tests, parametric test, non-parametric test. **Algorithms in R/Python:** How Regression Algorithm Work, Linear Regression, Logistic Regression, K-Nearest Neighbors Algorithm, K-means algorithm.	

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